Quincy, WA Data Centers

Potential Acute Health Impacts of Multiple Diesel-powered Emergency Generators' Emissions

Gary Palcisko
Air Quality Program
Washington State Department of Ecology

Data Centers

- Centralized placement of servers
  - increase their computing capacity
  - comply with new data-retention rules
  - simplifying their computing infrastructure

Key Considerations in Siting Data Centers

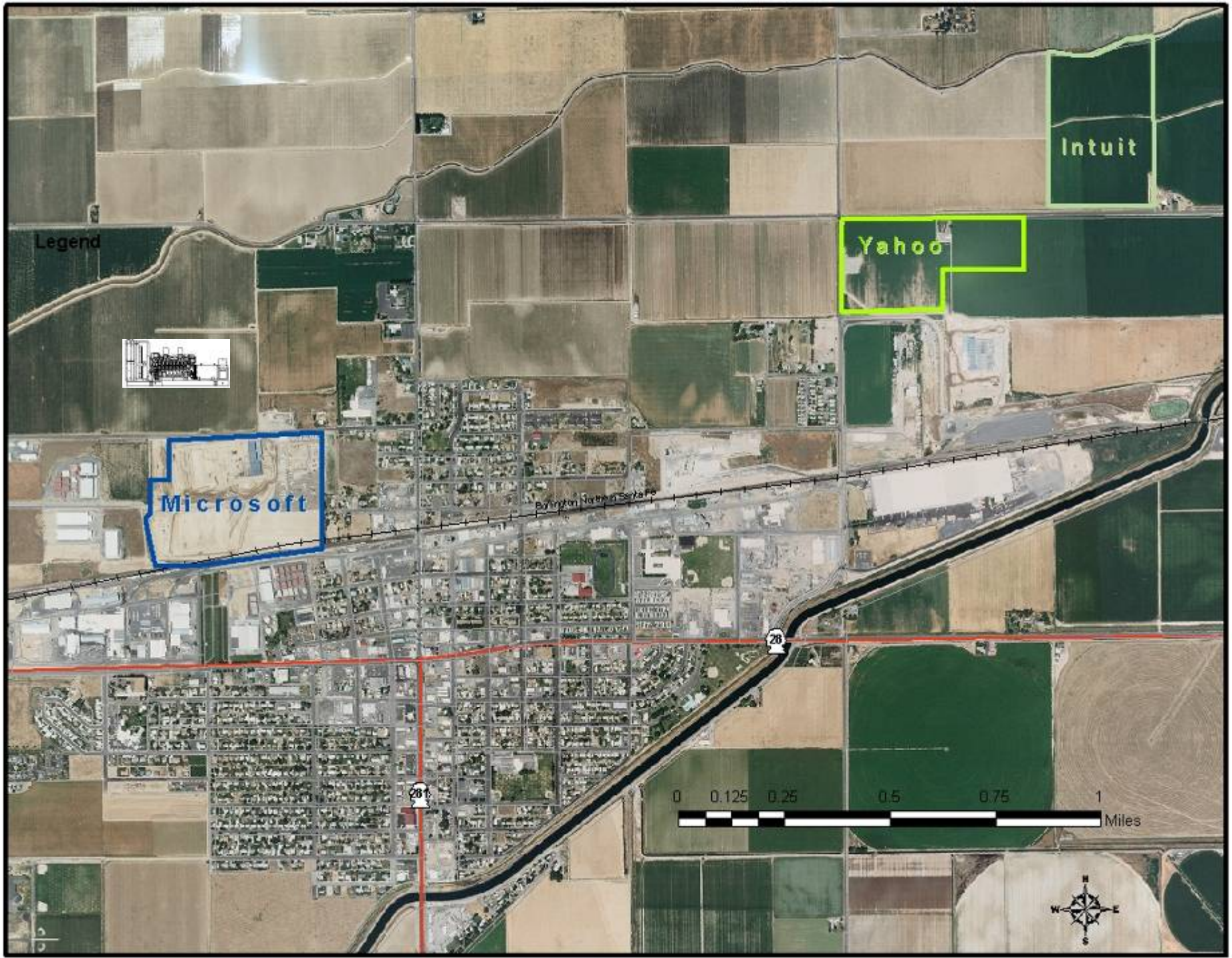
- Cost / availability of land
- Access to communications infrastructure
  - Fiber optic cable
- Security
- Minimal natural disaster threat
- Taxes
- Power stability
- Cost of energy


Whatcom
San Juan
Skagit
Okanogan
Ferry
Stevens
Pend Oreille
Clallam
Island
Snohomish
Chelan
Douglas
Lincoln
Spokane
Jefferson
Kitsap
King
Mason
Grays Harbor
Kittitas
Thurston
Pierce
Grant
Adams
Whitman
Pacific
Lewis
Franklin
Garfield
Wahkiakum
Yakima
Columbia
Walla Walla
Asotin
Benton
Cowlitz
Skamania
Klickitat
Clark


Quincy
Wanapum Dam
Priest Rapids Dam
N
W
E
S
Miles
0
3
6
12
18
24

Data Centers in Quincy, WA

- 2006 Microsoft
  - 74 acres, 48 megawatts of power drawn from the local power grid (when fully operational).
  - 24 – 2.4 megawatt diesel-powered backup generators
- 2007 Yahoo!
  - 50 acres
  - 13 - 2.4 megawatt diesel-powered backup generators
- 2007 Intuit
  - 63 acres (outside the current urban growth area)
  - 9 – 2.4 megawatt diesel-powered backup generator


Legend
Microsoft
Yahoo
Intuit
0 0.125 0.25 0.5 0.75 1
Miles

Air Emissions

- Under most conditions, data center air emissions are minimal
- System-wide power failure could result in the simultaneous operation of dozens of LARGE diesel engines

Ecology's NSR for Toxics

- T-BACT is required for any new or modified emission unit that has an increase in emissions of toxic air pollutants.
  - On-road specification diesel fuel with a sulfur content of 0.0015 weight percent or less, and compliance with the Environmental Protection Agency (EPA) Tier II standards (40 CFR 89) for non-road engines

Toxic Air Pollutants WAC 173-460

- About 500 or so chemicals
- Each TAP has an Acceptable Source Impact Level
  - 1×10^{-6} cancer risk
  - reference concentration from IRIS
  - ACGIH TLV with uncertainty factors applied

Tiered Process

- Tier I
  - Use screening process to determine if emission of TAP exceeds an ASIL
- Tier II
  - Use more refined model (e.g., AERMOD)
  - Submit Health Impacts Assessment
- Tier III
  - If cancer risk exceeds 1×10^{-5}, risk management process may be used… (NOTE: non-cancer hazards not addressed here)

Tier 1 – Diesel-powered Generators

- Arsenic
- Benzene
- Cadmium
- Lead
- Total PAH’s
- Nitric Oxide

Tier II – Diesel-powered Generators

- ~~Arsenic~~
- ~~Benzene~~
- ~~Cadmium~~
- ~~Lead~~
- ~~Total PAH's~~
- Nitric Oxide

Derivation of Nitric Oxide ASIL

- Based on occupational standard
- Uncertainty factors applied to protect general public
  - ~30,000 ug/m^3 8-hr TWA
    - 3 (converts 8 hours to 24 hours)
    - 10 (non-recovery factor)
    - 10 (sensitive individuals)
  - ASIL = 100 ug/m^3 24-hr avg

NOTE: ASILs currently being revised

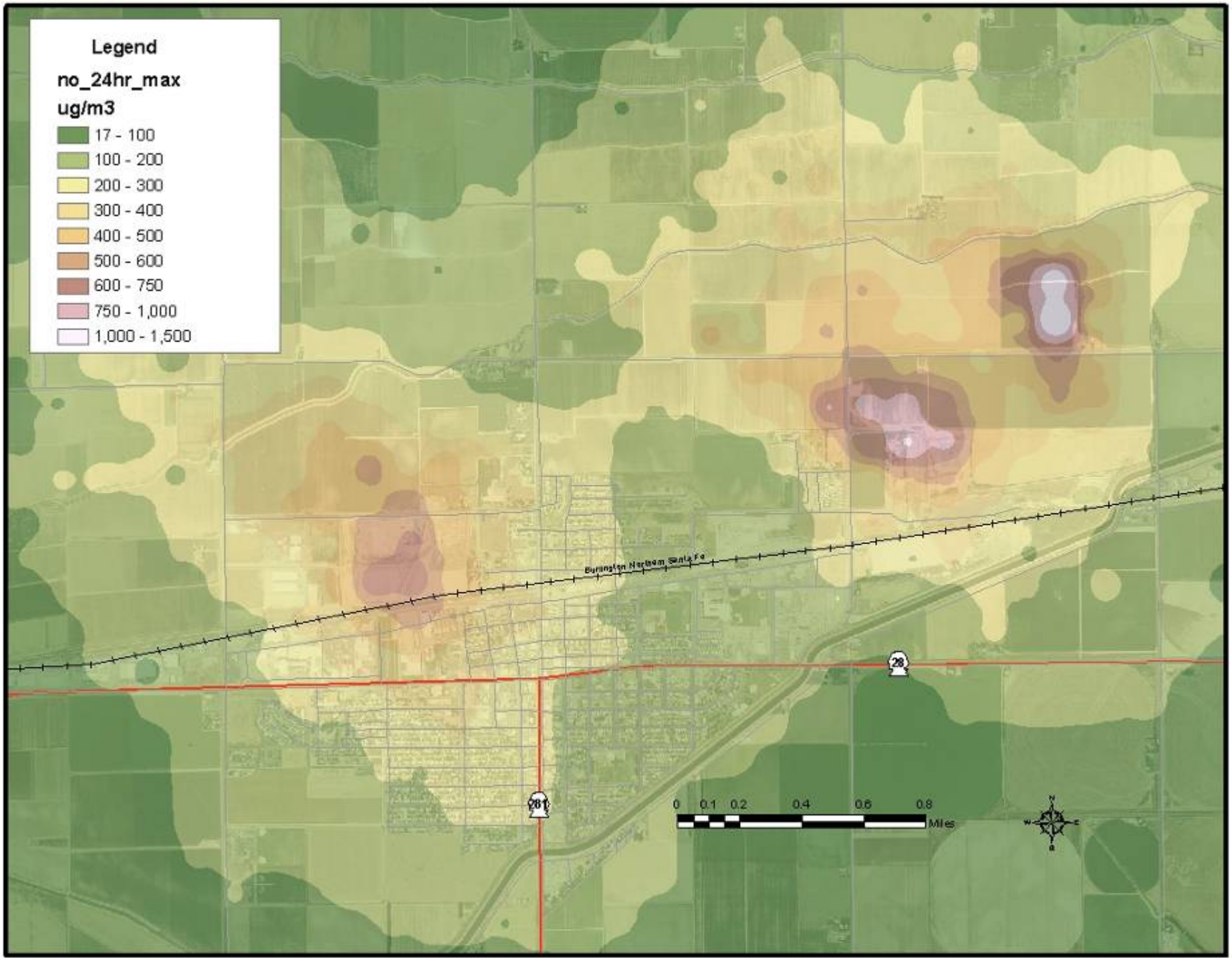
Nitric oxide will no longer be regulated under new source review for toxics

Quincy Data Centers

- Nitric oxide levels from each individual source were considered to be acceptable
  - NOTE: general population health based values for nitric oxide do not currently exist
- What about cumulative impacts?
- What about chemicals not currently regulated?
- Emergency planning?

Chemicals Emitted from Generators not Currently Covered by WAC 173-460

- NO_2
  - OEHHA Acute REL- 470 ug/m^3 (1-hr)
  - Acute Exposure Guidance levels (1-hr)
    - Level 1 (non disabling) – 940 ug/m^3
    - Level 2 (disabling) – 23,000 ug/m^3
    - Level 3 (fatal) – 38,000 ug/m^3
- DPM
  - IRIS RfC – 5 ug/m^3
  - OEHHA URF – 3 x 10^{-4}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no_24hr_max
ug/m3
17 - 100
100 - 200
200 - 300
300 - 400
400 - 500
500 - 600
600 - 750
750 - 1,000
1,000 - 1,500
Burlington Northern Santa Fe
28
281
0 0.1 0.2 0.4 0.6 0.8
Miles
N
W
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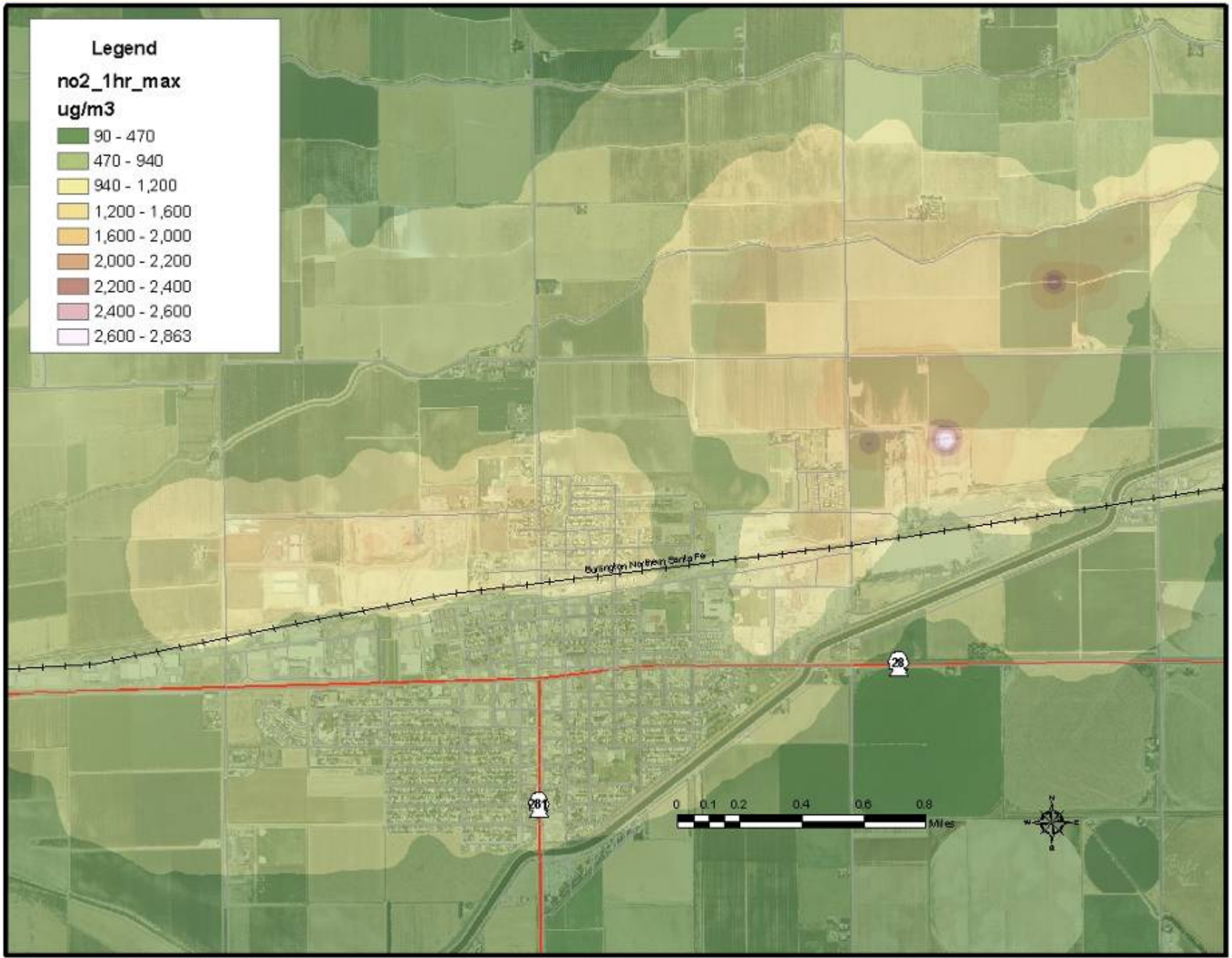
Legend
no2_1hr_max
ug/m3
90 - 470
470 - 940
940 - 1,200
1,200 - 1,600
1,600 - 2,000
2,000 - 2,200
2,200 - 2,400
2,400 - 2,600
2,600 - 2,863
Burlington Northern Santa Fe
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281
0 0.1 0.2 0.4 0.6 0.8
Miles
N
W
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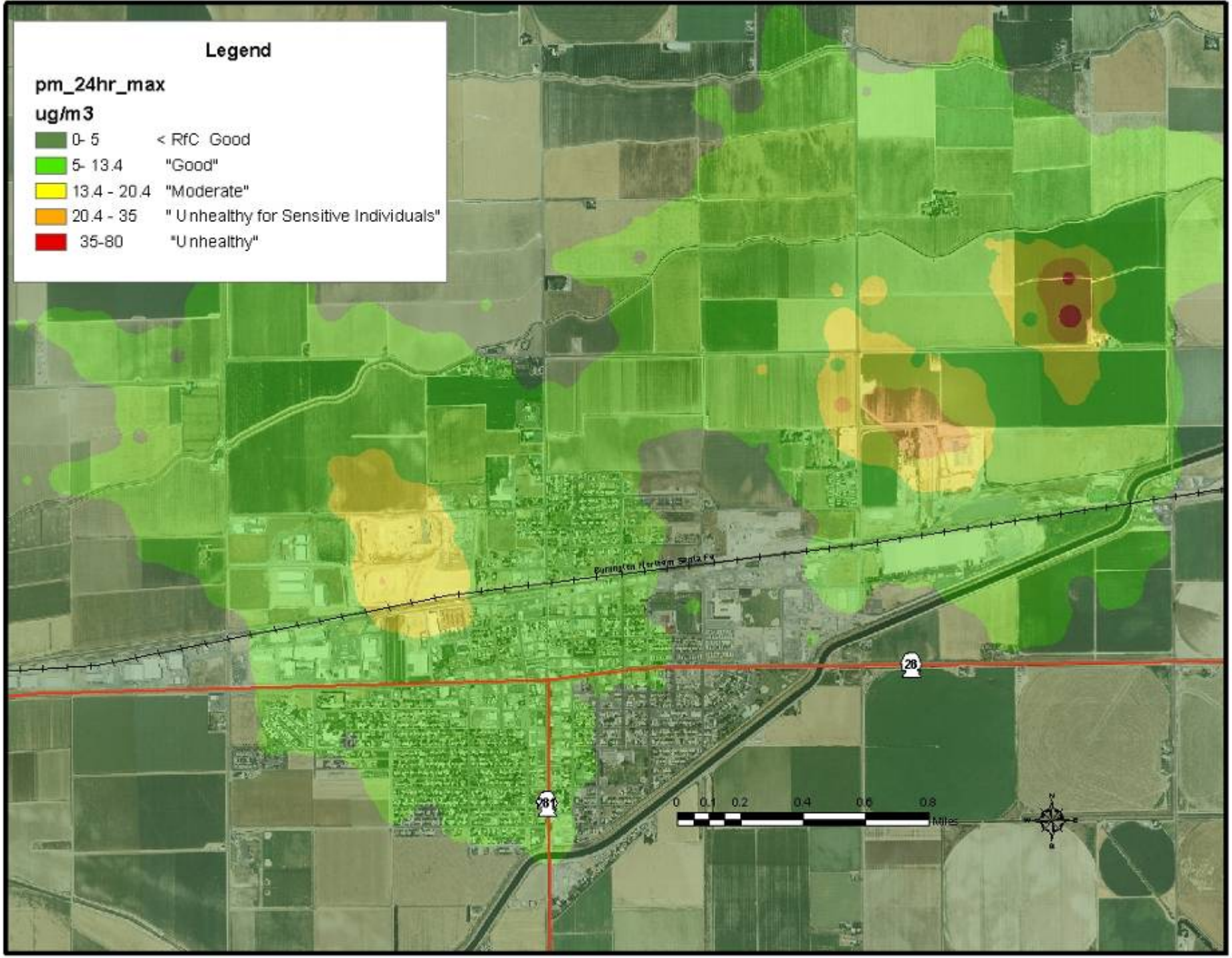
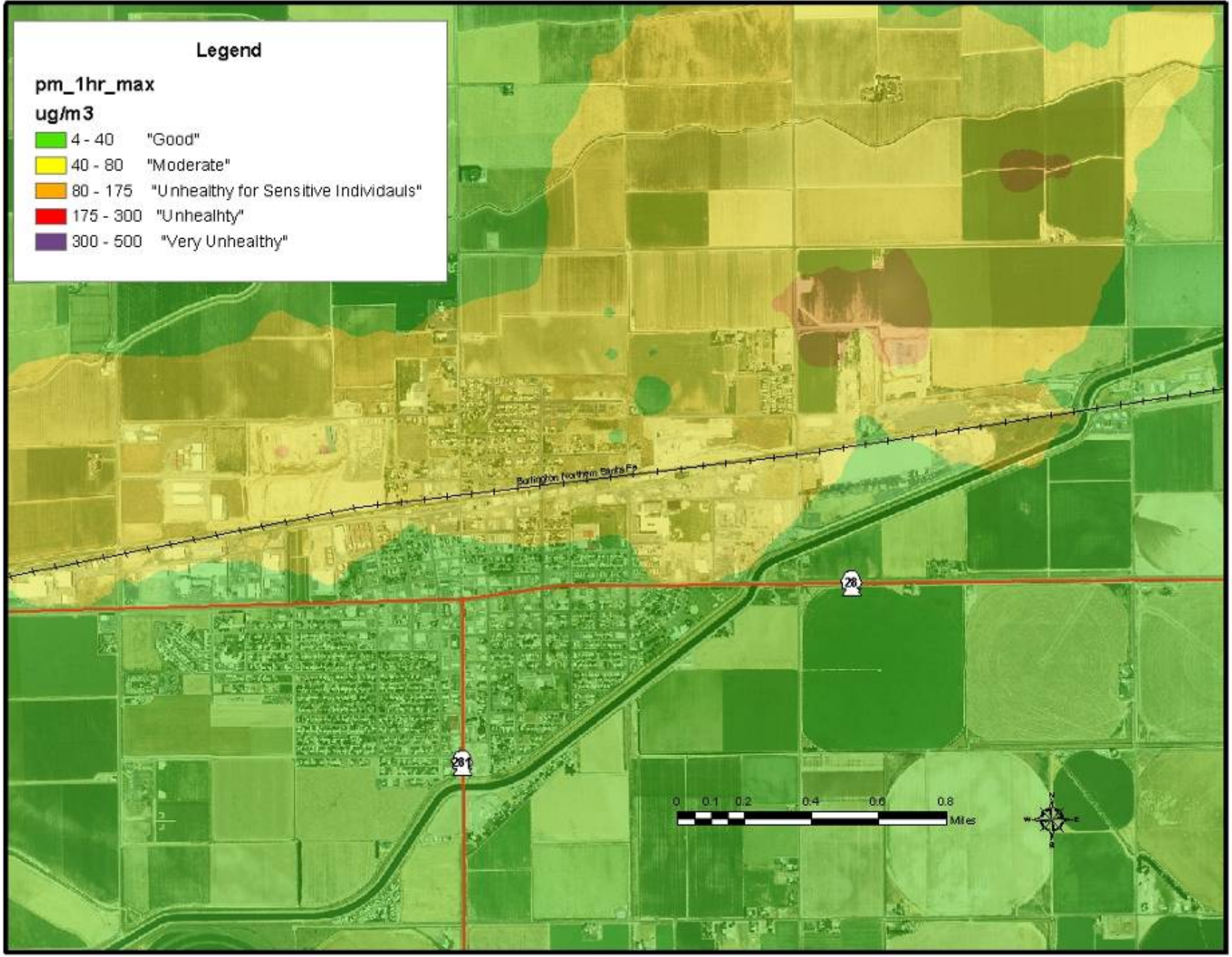

Legend
pm_24hr_max
ug/m3
0- 5 < RfC Good
5- 13.4 "Good"
13.4 - 20.4 "Moderate"
20.4 - 35 " Unhealthy for Sensitive Individuals"
35-80 "Unhealthy"
28
281
0 0.1 0.2 0.4 0.6 0.8
Miles


Legend
pm_1hr_max
ug/m3
4 - 40 "Good"
40 - 80 "Moderate"
80 - 175 "Unhealthy for Sensitive Individauls"
175 - 300 "Unhealhty"
300 - 500 "Very Unhealthy"
Burlington Northern Santa Fe
28
281
0 0.1 0.2 0.4 0.6 0.8
Miles

Acute Health Effects

- NO_2
  - 470 ug/m^3 –
    - increased airway reactivity (asthmatics)
  - 940 ug/m^3 –
    - Discomfort, burning of the eyes, headache, chest tightness, or labored breathing with exercise.
    - People with asthma are more likely to experience respiratory symptoms than the general public.
    - Most people will also be able to notice the bleach-like, acrid odor of NO_2.

Acute Health Effects

- $PM_{2.5}$
  - Respiratory Symptoms
    - Exacerbates existing illness
      - Asthma attacks
    - Increased hospitalization / emergency room visits
  - Mortality increases with $PM_{2.5}$
    - Cardiovascular
    - Respiratory

Remaining Questions

- How frequently would we expect meteorological conditions to result in 1-hr NO_2 concentrations above 940 ug/m^3 at various receptor points (residences, schools, and any place where people might be)?
- Would consideration of background/baseline $PM_{2.5}$ warrant risk management or emergency planning decisions?

The Future of Data Centers?

- NO_2 and DPM likely to trigger tier II
  - Acute
    - NO_2
      - 1-hr impact near data centers will likely exceed REL and AEGL
  - Chronic
    - DPM
      - 10 ug/m^3 DPM for 200 hours of power-outage over a 70 year period results in cancer risk of ~ 1 x 10^{-6}
- Tax incentives?


QUINCY
OPPORTUNITIES
UNLIMITED